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BOOK REVIEWS.

ANSCHAUUNG UND DENKEN IN DER GEOMETRIE. Akademische Antrittsvorlesung, gehalten am 22. Juli 1899. Von *Otto Hölder*, O. Professor der Mathematik in Leipzig. Leipzig: Druck und Verlag von B. G. Teubner. 1900. Pages, 75. Price, 2.40 Marks.

A thorough study of the methods of ratiocination employed in mathematics, mechanics, and the exact natural sciences has led Professor Hölder to the conviction that the deductive method there employed is made up of series of concatenated conclusions of quite characteristic form, and that consequently these sciences have a peculiar method and logic of their own. Not that the reasoning in these sciences is absolutely different from the reasoning in other departments of thought and life; the peculiarity in question resides entirely in the nature of the subject-matter and in the style of the combinations of the intellectual acts concerned.

A correct philosophy of mathematical procedure is to be reached, in Professor Hölder's opinion, only by the coöperation of mathematicians and philosophers, and not, as has been heretofore the case, by isolated and one-sided labors in this domain. The review which he himself gives of the modes of thought concerned is a very good one, and taken together with the exhaustive notes which he has suffixed to his discussion, will be found to be of assistance to students. He carefully distinguishes between the rôles which pure imagination (*Anschauung*) and pure thought play in geometry, and discriminates nicely between axioms of logic and axioms of experience. The arguments of the Kantians and the empiricists (the "physical geometers") are also examined.

Professor Hölder finds that there are involved in geometrical demonstration many elements which usually remain unemphasised in the formal proofs; for example, the auxiliary lines used in constructions involve what he calls *existentia-propositiones*, namely, propositions asserting the possibility of the constructions in question. These existential propositions enable us so to vary the figure which we are considering that in the working out of a geometrical proof we are virtually performing an intellectual experiment quite after the fashion of natural experiments; and this is deduction. Further, the eye performs a distinct rôle in the succession of acts necessary to the constructions of the proof, as when we observe, for in-

stance, that a certain three angles together make two right angles. Again, the demonstration is carried out in connexion with a single typical figure which must be considered movable and to occupy all possible positions if the deductions are to be universally valid, and in this manner the demonstration is said always to involve an *inference from analogy*. Further, *axioms of arrangement* or *disposition*, as Hilbert has termed them, are involved. These and similar subsidiary implications are largely visualistic in character, and the question arises as to how far they may be stripped of their visualistic elements and reduced to purely rational forms. Leibnitz believed he could reproduce by symbolism all the elements involved in the visualistic procedure, but for various reasons Professor Hölder is of the opinion that this is possible only for limited domains. He next considers the doctrine of proportion, and seeks to analyse the assumptions therein involved, one of which he finds to be the axiom that certain geometrical operations can be repeated an indefinite number of times. The idea that the contents of figures of different forms are comparable is in his opinion also in need of demonstration. Considering the method of exhaustions, he concludes that it is impossible to banish indirect demonstrations from geometry, and he is also of the opinion that the demonstrations of mechanics are not essentially different from those of mathematics, inferences from experience and analogy being involved in both, though in varying degree.

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IMMANUEL KANT'S KRITIK DER REINEN VERNUNFT. Edited by *Benno Erdmann*.

Berlin: Druck und Verlag von Georg Reimer. 1900. Pages, xii, 609. Price, 4 marks.

BEITRÄGE ZUR GESCHICHTE UND REVISION DES TEXTES VON KANT'S KRITIK DER REINEN VERNUNFT. Anhang zur fünften Auflage der Ausgabe. By *Benno Erdmann*. Berlin: Druck und Verlag von Georg Reimer. 1900. Pages, 115. Price, 2 marks.

KANT'S CRITIQUE OF PURE REASON. Translated by *F. Max Müller*. New York and London: The Macmillan Co. 1896. Pages, lxxxii, 808.

The fifth edition of Prof. Benno Erdmann's exemplary edition of Kant's *Critique of Pure Reason* is based (1) on a new and thorough collation of the two first original editions, (2) on a thorough collation of the second edition with the third, fourth, and fifth editions in some places, and (3) on a comparison of the second edition with the third, and the fourth with the fifth, in all passages in which the text of the editions subsequent to 1838 gave occasion for suspecting the text of the standard second edition. The great care and labor which Dr. Erdmann has bestowed upon his work sprang from the conviction that previous editors and emendators had erred in two not unessential points. Every editor since Rosenkranz has religiously kept on modernising the text, changing the punctuation and orthography, and even the words of the text. The result has been a rather chaotic con-